

Goshen North Site Visit

Idaho Falls, Idaho
May 18-20, 2009

- Ridgeline started in 2000
- Developed 65 MW Wolverine Creek Wind Farm E of Idaho Falls. Power Purchase Agreement with **Pacificorp/Rocky Mountain Power**
- Built 125 GNII Summer 2010. 50% joint venture with BP Wind. Power Purchase Agreement with **Southern California Edison.**
- Rockland Wind Farm: 80 MW PURPA project south of American Falls. Power Purchase Agreement with **Idaho Power** presently under consideration at Idaho Public Utilities
- 200 MW project South of Laramie – likely next project to see construction
- Now Ridgeline is wholly owned by Veolia Environmental
- Headquartered in Seattle with Offices in Boise, Portland, Idaho Falls, Spokane and Albany, NY.



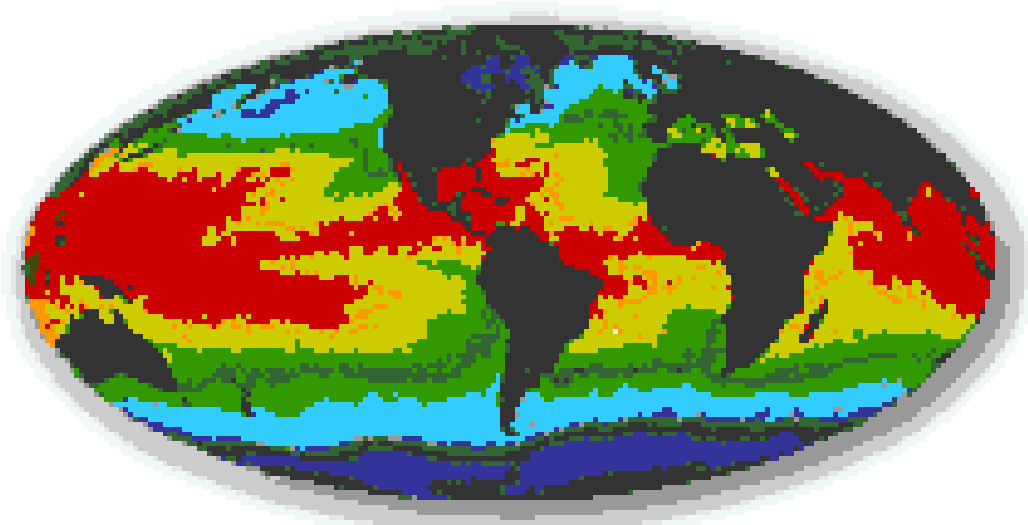
Pingree Middle School Field trip to Wolverine Creek Wind Farm



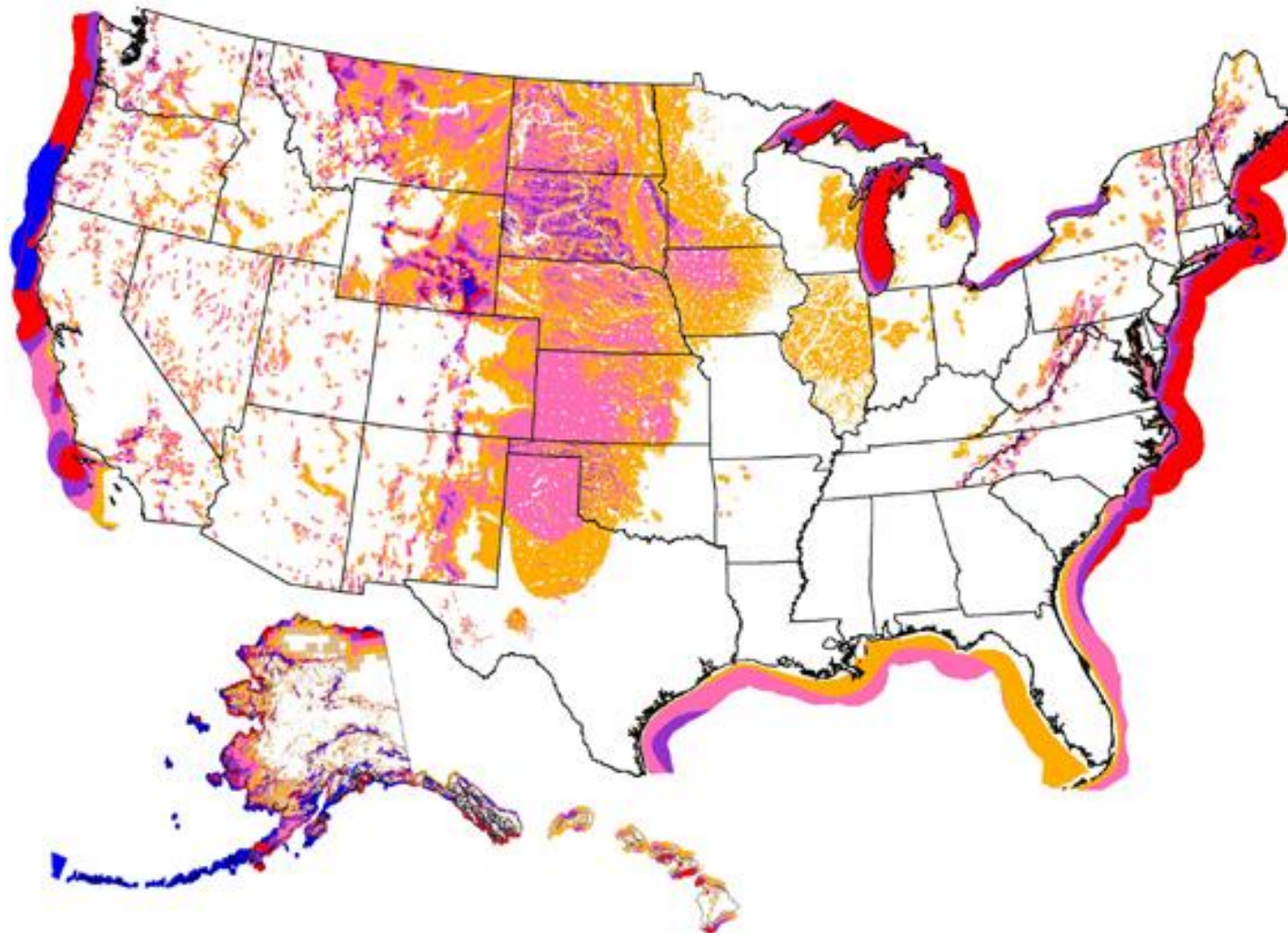
When and where does the wind blow?



- All renewable energy(except tidal and geothermal power), and even the energy in fossil fuels, ultimately comes from the sun.
- The sun emits 386 billion billion megawatts of energy.
- 174 billion megawatts of that energy reaches the earth's surface
- About 1 to 2 per cent of that energy is converted into wind.
- That is about 50 to 100 times more than the energy converted into biomass by all plants on earth.

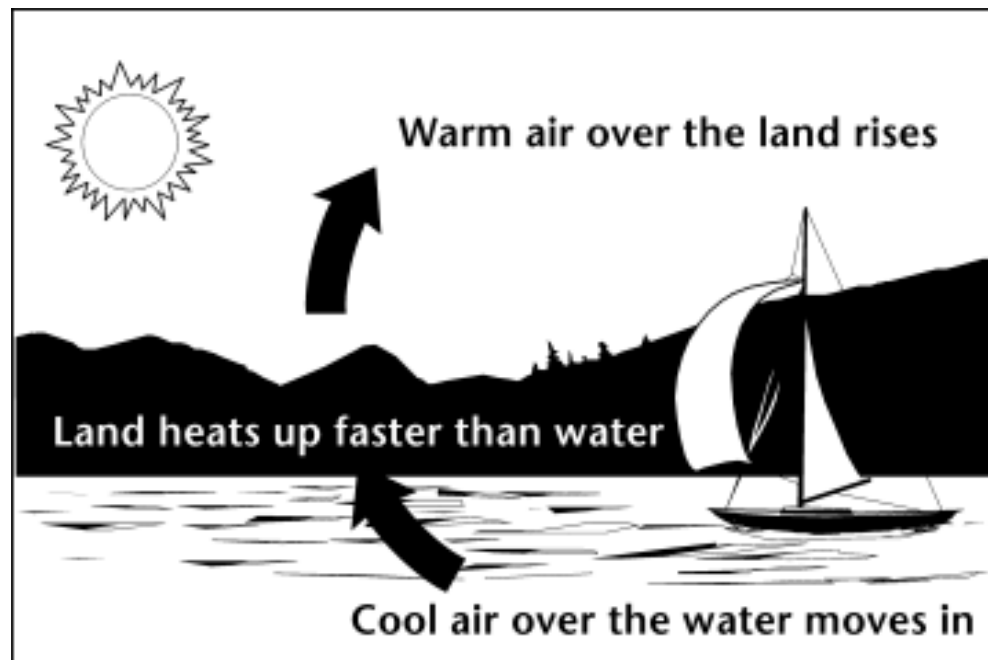


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SOURCE: US DOE Wind Powering America

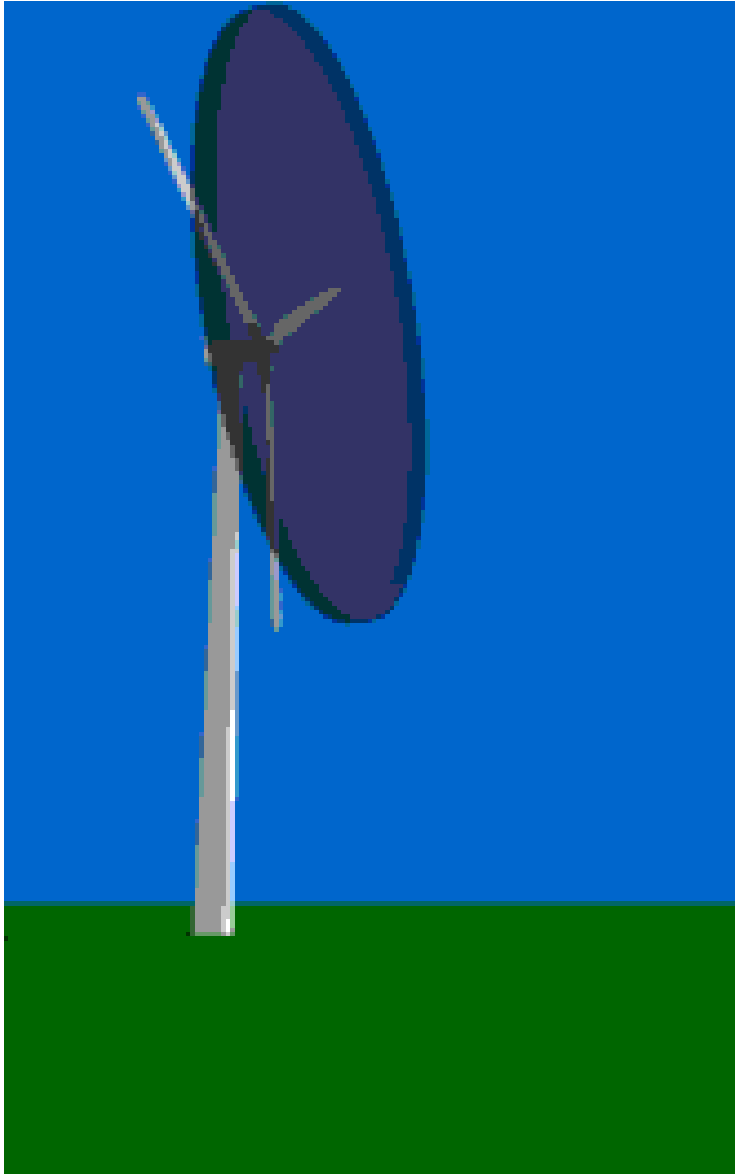
- During the day, the air above the land heats up more quickly than the air over water. The warm air over the land expands and rises, and the heavier, cooler air rushes in to take its place, creating winds. At night, the winds are reversed because the air cools more rapidly over land than over water.
- In the same way, the large atmospheric winds that circle the earth are created because the land near the earth's equator is heated more by the sun than the land near the North and South Poles



Source:
US DOE

How do turbines generate power?

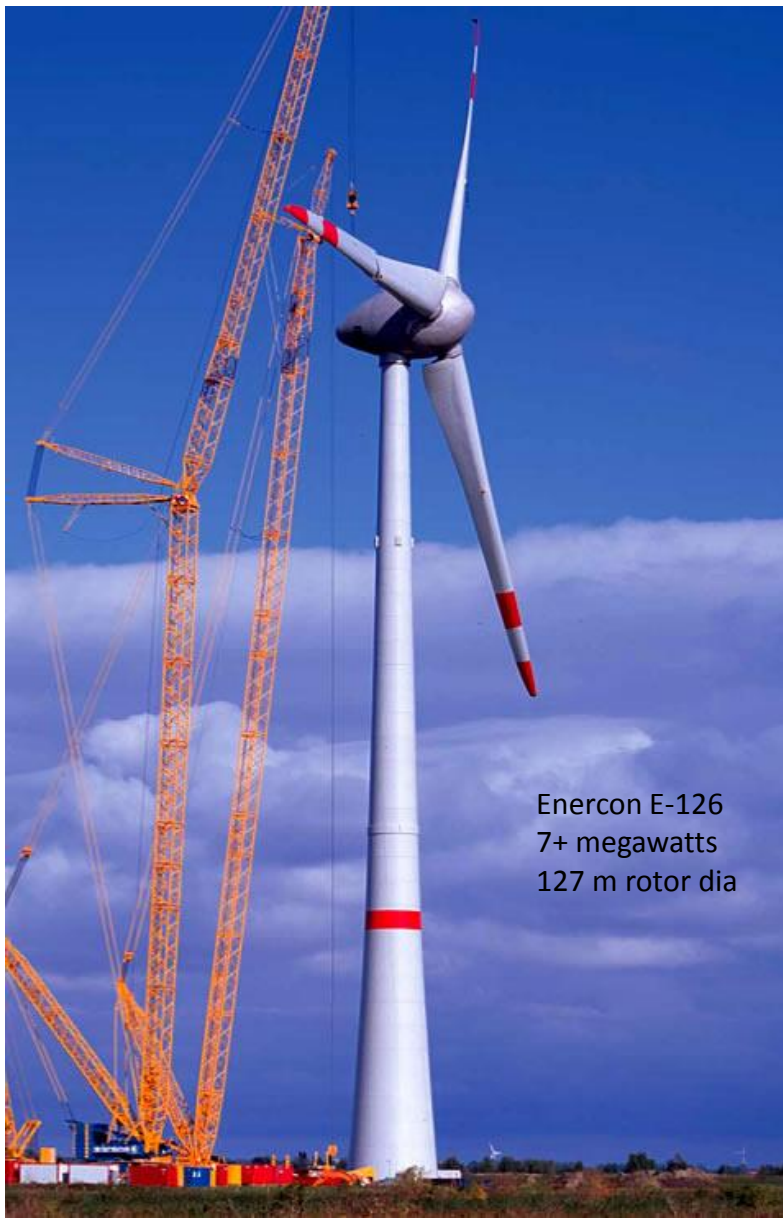




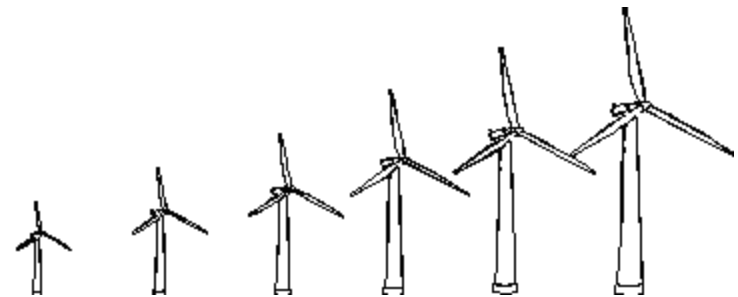
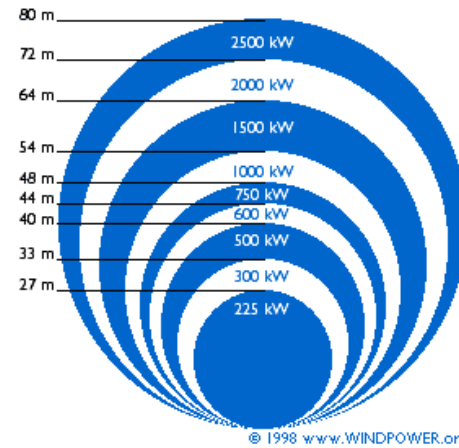
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Wind energy is a factor of three things

- **Air Density**
 - Dense air packs more power
 - Lower Temperatures
 - Lower Humidity
- **Rotor Area**
 - Bigger Area, More Power
 - Double the Rotor Diameter
 - get 4X the power
- **Wind Speed**
 - Exponential increases in energy
 - Doubling the wind cubes power
 - $2^3 = 2 \times 2 \times 2 = 8$
 - Double the wind speed get 8X the power
- **Double Rotor Area & Wind Speed**
 - Increase energy output by 32 times!!! ($4 \times 8 = 32$)



Enercon E-126
7+ megawatts
127 m rotor dia

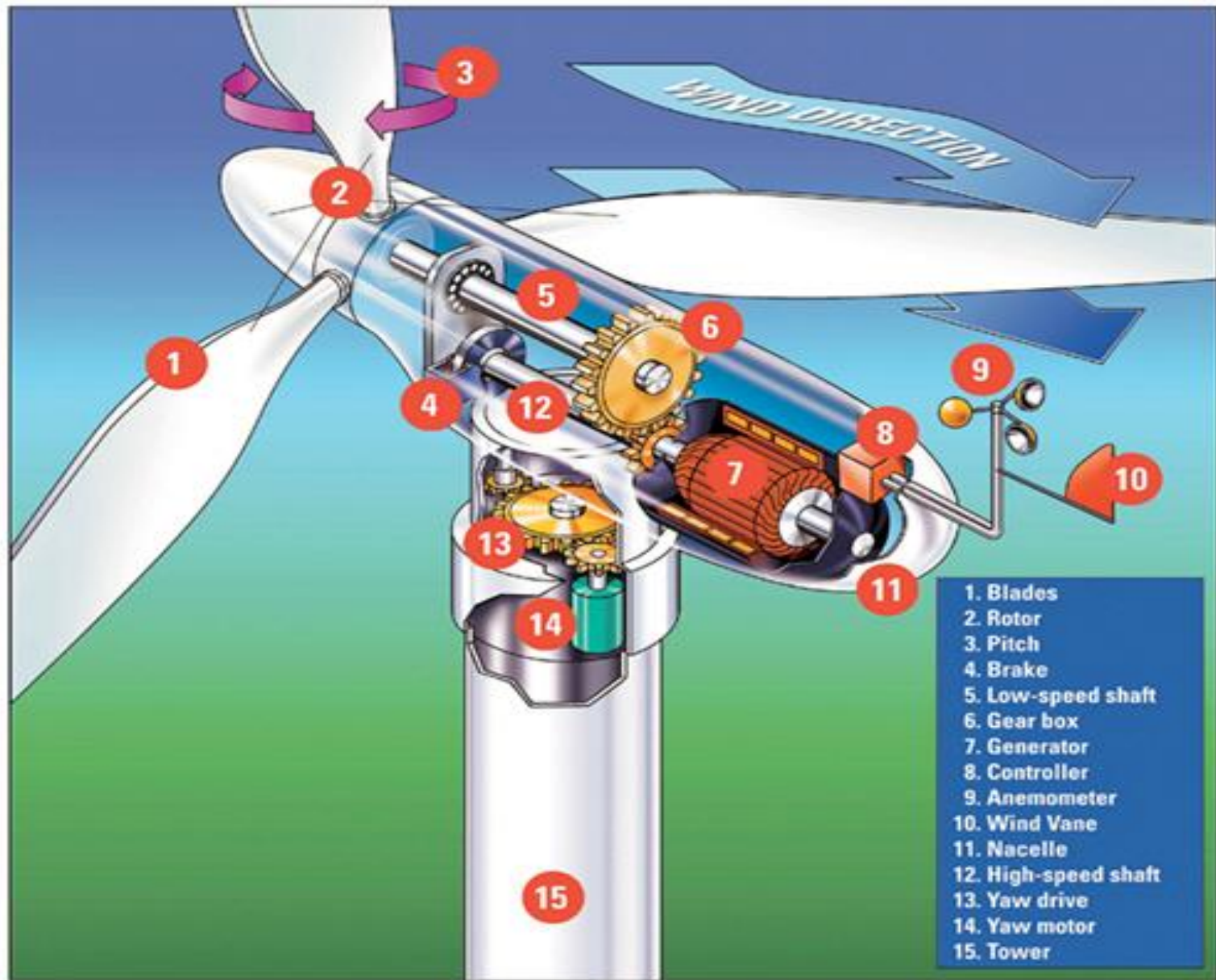


Year	1981	1990	1995	2000	2004	2008
Rotor	10m	27m	36m	47m	72m	127m
kW	25	225	450	660	2,000	7,000+
mWhr	45	550	1,280	2,377	5,800	20,000

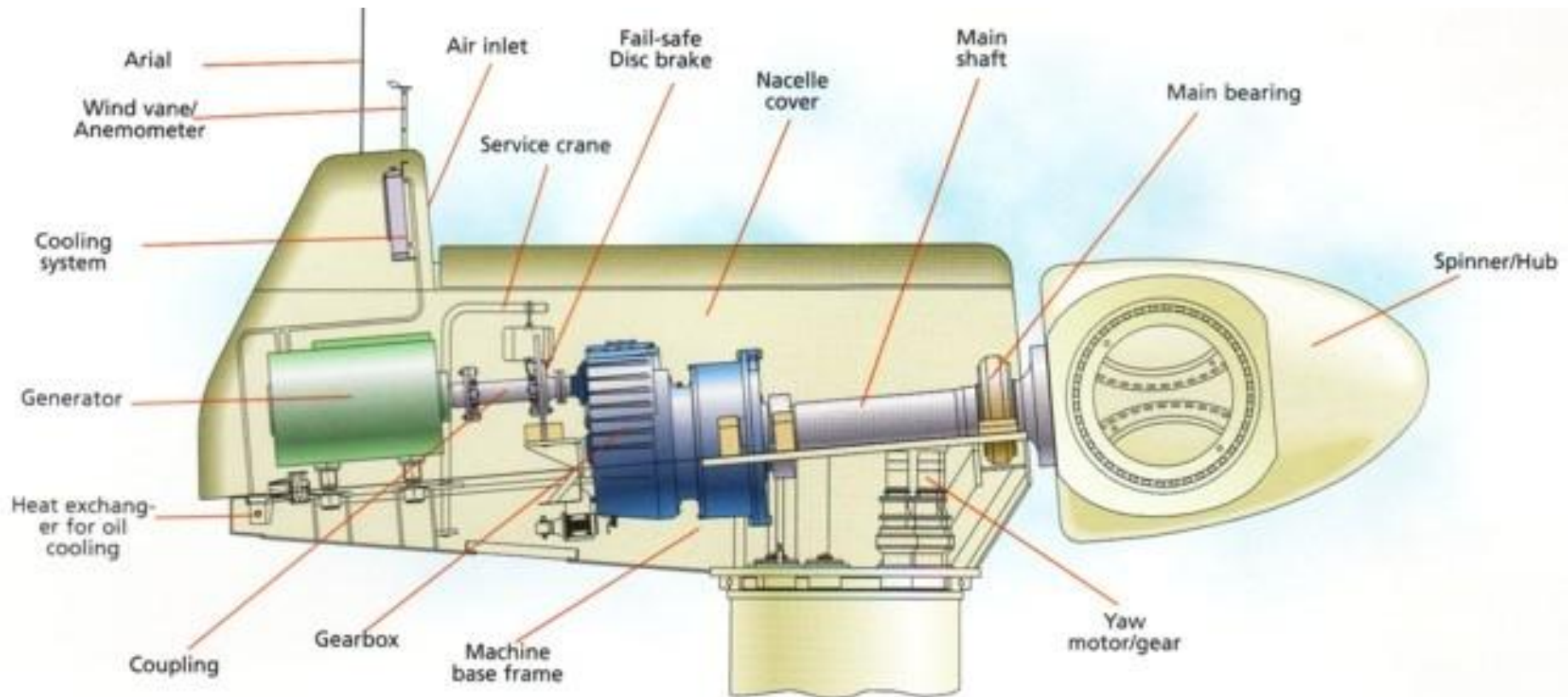
61 meter blades: 200 feet; 11 ton rotor section; 6 ton tip



- Clipper Liberty 2.5 mW:
 - 104 Ton Nacelle
 - Housing 22 ft x 17 ft
- Vestas V-90 1.8 mW
 - 148 ft blades
 - 75 ton nacelle
 - 40 ton blade assembly
- GE 1.5 mW (70m rotor d)
 - 116 foot blade
 - 56 ton nacelle
 - 36 ton blade assembly
- Gamesa G87
 - 143 foot blades
 - 72 ton nacelle
 - 42 ton blade assembly

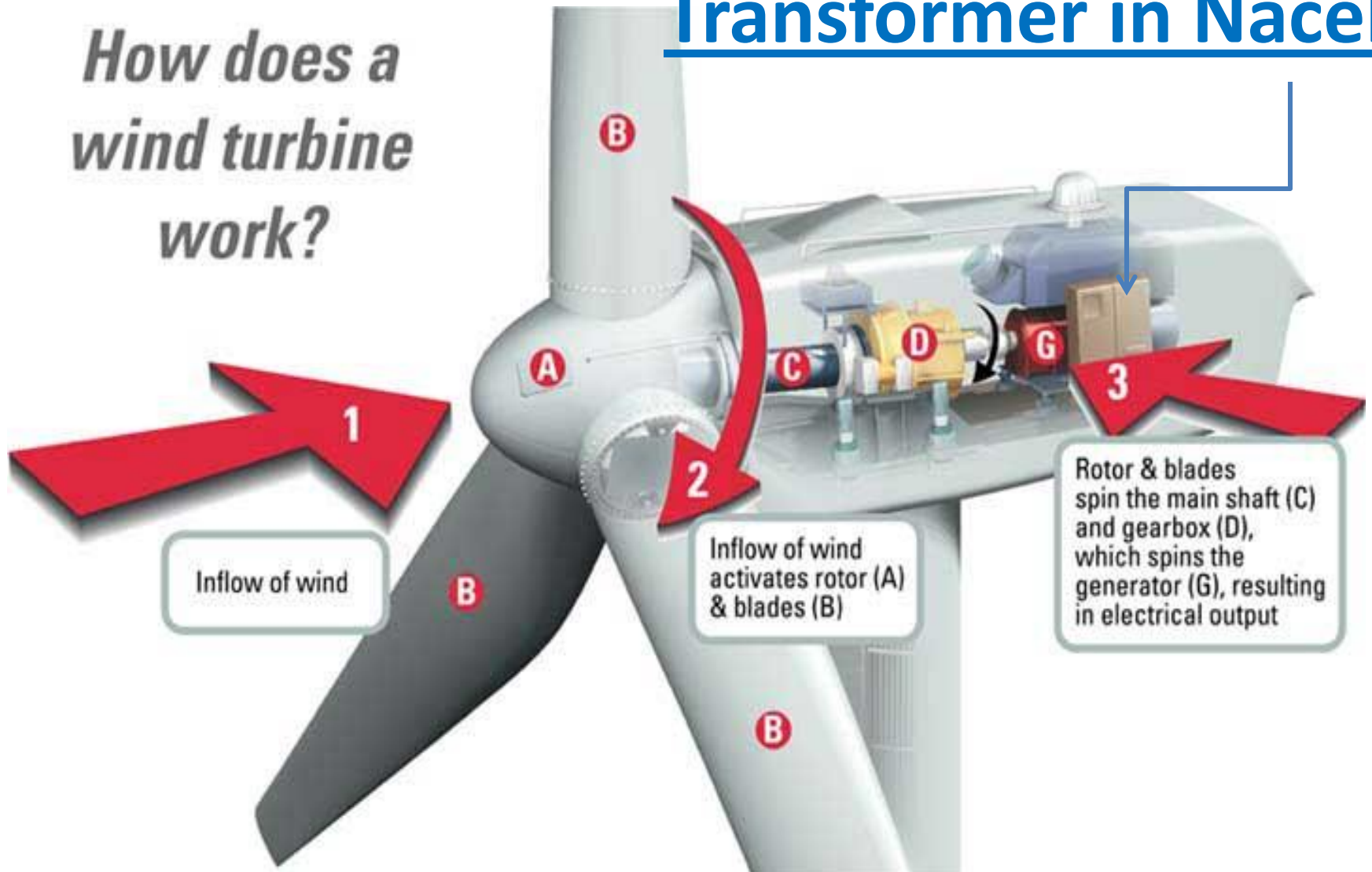


Inside a Wind Turbine



Transformer in Nacelle

*How does a
wind turbine
work?*





Overview of the Construction Process

Typical sequence of wind farm construction

- Access Roads
- Concrete Batch Plant (if required)
- Public Road Improvements (if required)
- Turbine Foundations
- Electrical Collection System
- Wind Turbines
- Project Substation
- Operations and Maintenance Facility

Install erosion and sediment controls



Clear and Grade Road



Install required drainage (i.e. culverts)



Install base materials (i.e. geo-fabric or Geo-Grid)



Install and compact gravel road



Concrete Batch Plant (if required)

- Requires an air quality permit



Turbine Foundations, continued



Turbine Foundations, continued



Turbine Foundations, continued



Turbine Foundations, continued



Turbine Foundations

- Temporary turbine workspace typically 150 – 200 foot radius
- Permanent area of disturbance typically 50 foot radius



Public Road Improvements

- Road and intersection widening
- Culvert and bridge replacement
- Reconstruction of previously existing roads
- Often requires road permits from DOT, County



Heavy Loads 9 to 11 Axles









Electrical Collection System



Electrical Collection System, continued





Wind Turbine Erection



Wind Turbine Erection, continued



Mullen Crane, Soda Springs, ID Erecting Wind Towers East of Mountain Home March, 2008



Wind Turbine Erection, continued



Wind Turbine Erection, continued





Wind Turbine Erection, continued



Project Substation

- Be sure to install appropriate secondary containment in accordance with SPCC regulations



Restoration and Reclamation

- Restore and reclaim
In accordance with
Issued permits and
agreements with various
agencies (i.e. agricultural)
and landowners



A photograph of a dirt road winding through a grassy field. In the background, several large white wind turbines are visible against a hazy sky. A small dark animal, possibly a cow, is grazing in the field. The text is overlaid on the left side of the image.

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